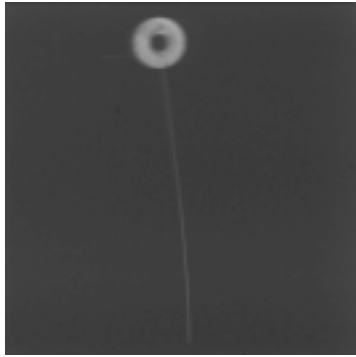


Overview of Microsystems & Materials Mechanics Organization



John R. Garcia
Manager



Sandia National Laboratories

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Fall 2002

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Engineering design

Problems
Worked

..... has its challenges:

- fatigue, fracture, failure
- friction
- length scale effects



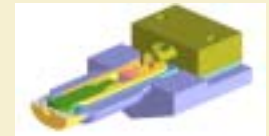
Solutions
Provided

Investigate, experimentally:

- Damage mechanisms
- Performance of components
- Age related mechanics issues

Provide experimental data:

- New material models
- Validation & uncertainty quantification of predictions



“Provide Highest Quality Experimental Solutions for Hardest Mechanical Problems”

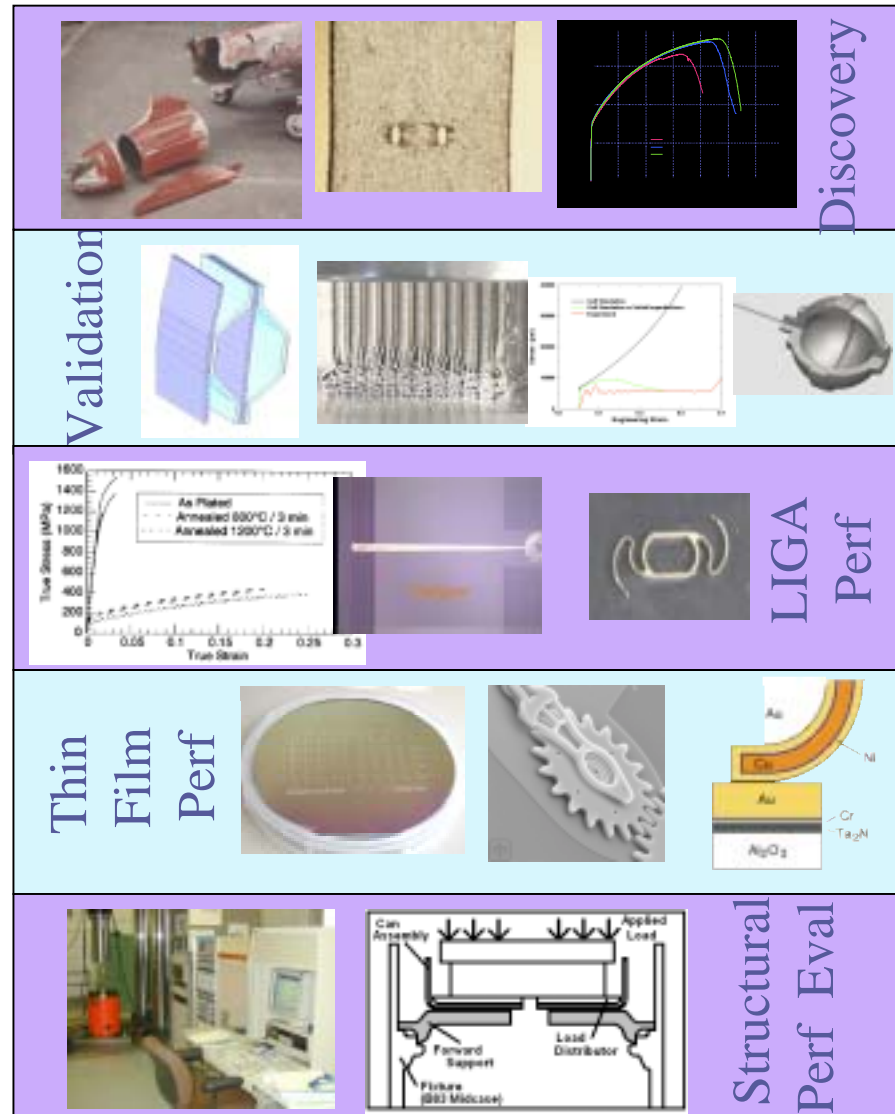
Vision
for our
Group

- Physical evaluation of stockpile components in stressing environments
- Predictive ASCI mechanics codes
- Microsystems in stockpile

Microsystems



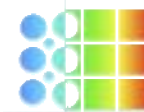
Experimental Highlights



We have a diverse staff

- 23 people TODAY: Mechanical Engineers & Technologists, Metallurgists & Material Scientists, MEMS experts . . .
 - 8 Ph.D's: MIT, Yale, RPI, Stanford, Georgia Tech, Michigan, Minnesota . . .
 - 2 engineers
 - 2 post docs
 - 3 technologists
 - 2 contractors
 - 1 visiting professor
 - 3 Summer students
 - 1 co-op student
 - 1 part-time college student

*Service Times: Nearly 30
Years to a few weeks!*

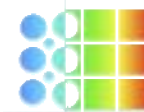


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We're active externally

All within the last year

- 5 Conference Proceedings (1 invited)
- 9 Journal Publications (3 first author)
- Editorial Board: Journal of Strain Analyses
- 2 Technical Advances and 2 Patent Applications
- Co-chair: TMS; Session Chair: ASME
- Academia: Campus Executive Fellowships (Stanford, Berkeley), Presidents Early Career Award Fellowship at Washington State University
- Students: 7 summer (ACRI, MPP, ESSI), 1 co-op



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Our staff was part of a team DOE Award of Excellence



The Plastics & Materials Implementation Team
“created and matured new materials-intensive
technologies for defense program applications”

Tom Bennett
Paul Dentinger
William Even
Steve Goods
Marion Hunter

Pat Keifer
LeRoy Whinnery

Spring 2002

Our staff was part of a team Sandia Employee Recognition Award



Materials-Advanced Options Team Award in Summer 2002:

Bob Bradshaw
Paul Dentinger
William Even
Steve Goods

Marion Hunter
Charisma Jackson
Pat Keifer

Jim McElhanon
LeRoy Whinnery
Thomas Zifer



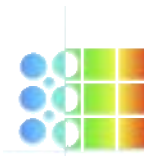
ASM International



Neville R. Moody

was named a Fellow in the American Society for Materials (ASM) International “for outstanding contributions to the understanding of hydrogen effects on material behavior, interfacial fracture and properties of thin films.”

Summer 2002



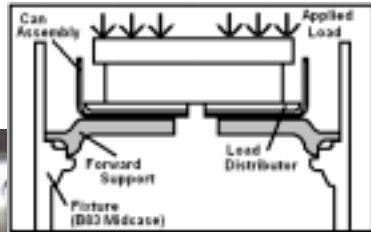
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What Sandia/California Test Laboratories Exist?

Engineering Mechanics

Structural Evaluation including micro/nano mechanics labs



Vibration & Mechanical Shock



Mass Properties: CG, POI, MOI



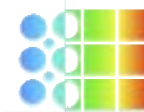
Climatic Chambers: Temp, Humidity, Altitude



Radiography: Diagnostics

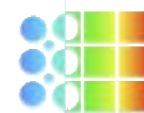
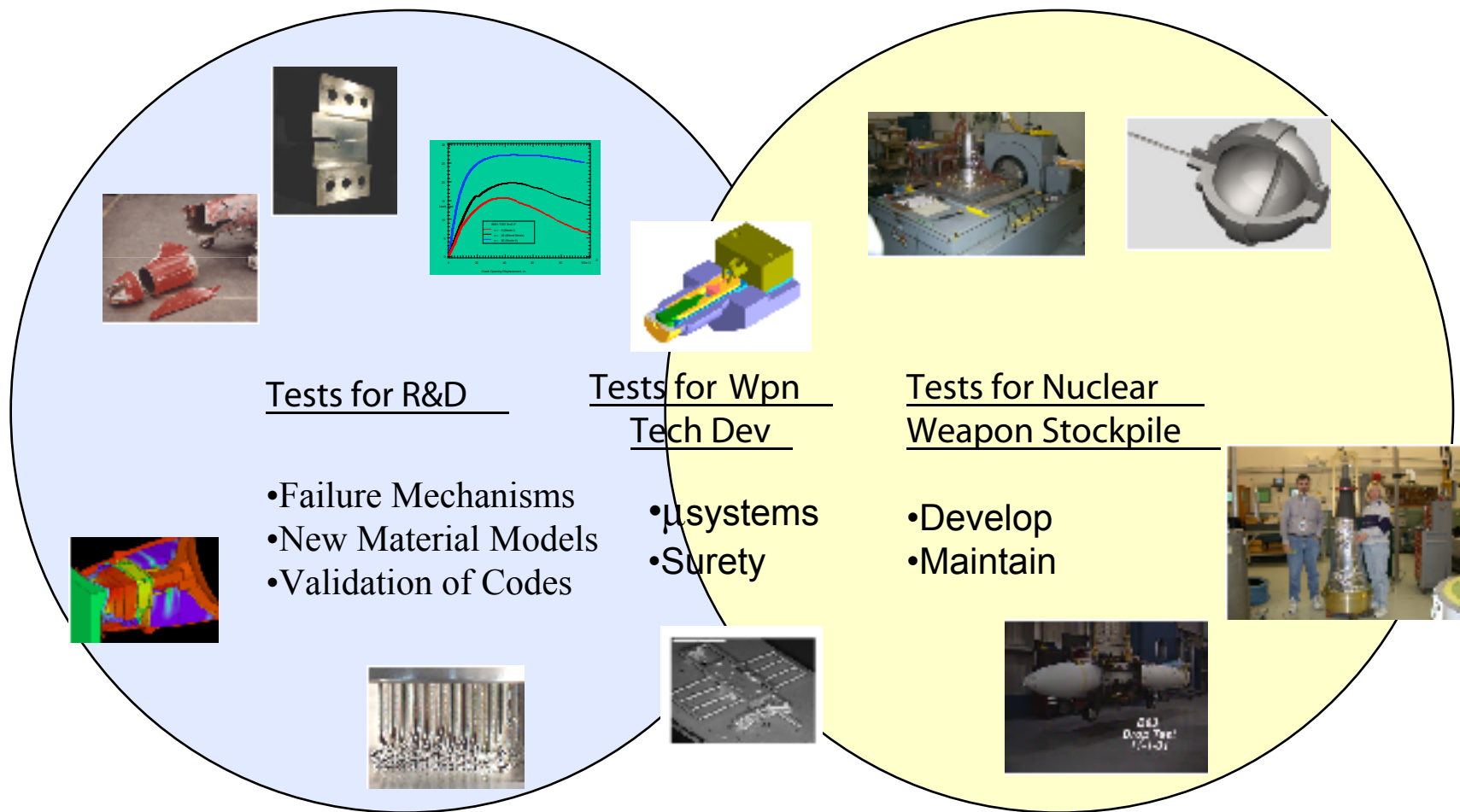


Centrifuges: Linear Acceleration



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Sandia/California Test Activities

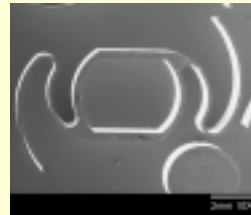


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Upcoming μ system studies and new laboratories

- **Thermal/Electrical Conductivity Studies in LIGA & Silicon**

LIGA Electrical Contact Spring



Silicon Thermal Conductivity Studies

In-Situ SEM LIGA Testing



- **Structural performance evaluation studies of devices fabricated from LIGA materials**

- **Establishing clean rooms and purchasing equipment for LIGA device test & evaluation**



We're purchasing new capital equipment

**Funded
in '03**

**Funded
in '03**

**Funded
in '04?**

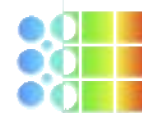
Center	Requesting Manager / Requestor	CEFR ID #	Description	Cost (in K's)	Program Type	BLT Category	Site Vision Goal	Replacement / Addition
8200	Bruce Affeldt (8225)	2170	Robotically controlled, ultrasonic enhanced Printed Wiring Process/Plating Line	\$500	DSW NA-11	A	1	Replace
8200	J. P. Van't Hof (8232)	2208	Millimeter wave capable radio frequency vector network analyzer	\$190	DSW NA-11	A	1	Add
8200	Bruce Affeldt (8225)	2175	Vibration Controller/Data Acquisition System	\$250	DSW NA-11	A	1	Replace
8700	Even/McElhanon	2293	NMR	\$530	DSW NA-11	A & C	1	Replace
8200	Mike Hardwick (8243)	2212	Inertia Welder	\$380	DSW NA-11	A	1	Add
8700	Garcia/Moody	1971	Nanoindenter	\$275	Campaigns	A & B	1 & 3	Add
8700	Wang/Antolak	2297	Nanofocus X-ray Source	\$150	Campaigns	A & B	1 & 3	Replace
8200	Paul Lowe (8232)	2186	DR 2000-RF Digital Receiver system	\$105	DSW NA-11	A	1	Add
8700	Chen/Hughes	2302	Electron Energy Imaging System	\$425	Campaigns	A & B	1 & 3	Add
8200	Mike Hardwick (8243)	2211	Laser Welder	\$250	DSW NA-11	A	1	Replace
8200	Jim Lund (8232)	2185	Nuclear VME Readout System for Radiation Detector Development	\$114	DSW NA-11	A	1	Replace
8200	Bruce Affeldt (8225)	2180	Free-Fall Shock Machine	\$95	DSW NA-11	A	1	Add
8300	Gallagher/Behrens	2005	Femtosecond Laser System	\$427	DSW NA-11	A	None	Add
8200	Bruce Affeldt (8225)	2182	Small Capacity Water Jet approx 36x48" area, self-contained	\$125	DSW NA-11	A	1	Add
8200	Bruce Affeldt (8225)	2187	EDM Sinker (electrical Discharge Machine - Sinker)	\$275	DSW NA-11	A	1	Add
8200	John Becker (8233)	2184	4 GHz High-Performance Oscilloscope	\$100	DSW NA-11	A	1	Add
8200	Bruce Affeldt (8225)	2205	Laser Machining Center from Haas	\$280	DSW NA-11	A	1	Add
8200	Bruce Affeldt (8225)	2200	Medium Capacity CNC Lathe 18" by 6'	\$185	DSW NA-11	A	1	Replace
8200	Bruce Affeldt (8225)	2197	Farro Arm - fully portable measuring device (CCM)	\$150	DSW NA-11	A	1	Add
8700	Even/Domeier	2304	Hot Embosser	\$350	DSW NA-11	A & B	1 & 3	Replace
8700	Cadden/Bastasz	2308	LEIDS	\$140	Campaigns	A	1	Add
8700	Garcia/Lu	2024	Micro Scanning Vibrometer	\$250	DSW NA-11	A & B	1 & 3	Add
8700	Ortega/Kistler	2311	Computer Server	\$104	DSW NA-11	A	1	Add
8700	Henderson	2315	Vacuum Scanner	\$575	DSW NA-11	A	1	Add
8700	Cadden/Smugeresky	2317	LENS	\$450	DSW NA-11	A	1	Add
8700	Garcia/Lu	2278	Dynamic Nanotensile Tester	\$125	DSW NA-11	A	1 & 3	Add
8700	Wang/Sickafoose	2322	FTIR	\$150	Campaigns	A & C	1	Replace
8700	Wang/Mills	2324	TGA	\$80	Campaigns	A & C	1 & 3	Replace
8200	Greg Thomas (8220)	2302	Hybrid Micro Testing Station	\$250	DSW NA-11	A	1	I do not have the paperwork for this

**#3 Vib
Controllers**

**#6 Nano-
Indenter**

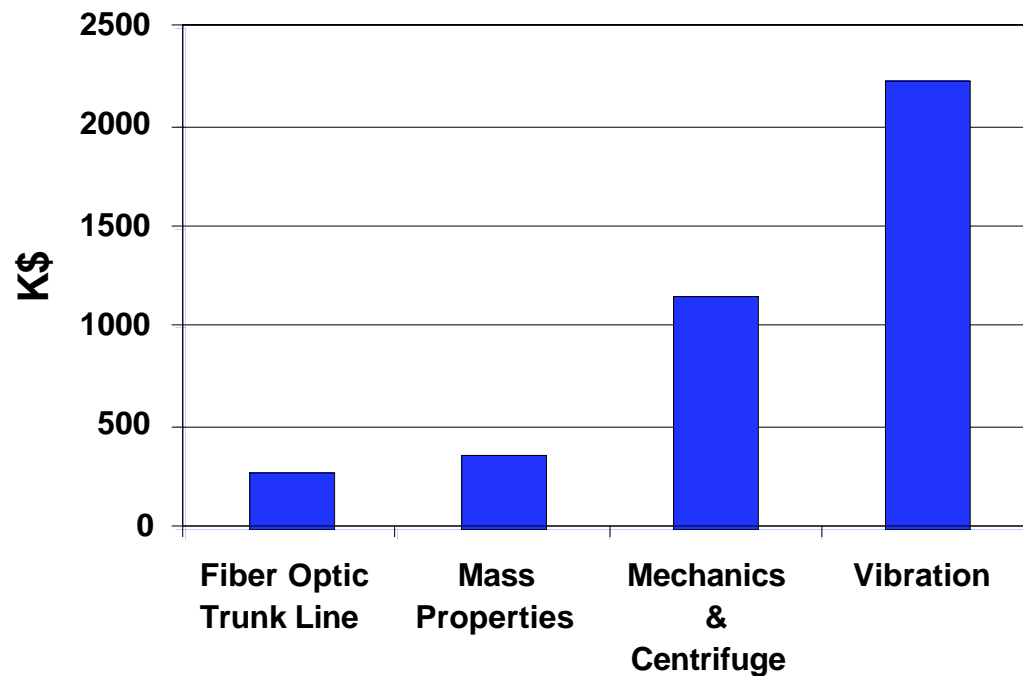
**#12 Shock
Machine**

**LIGA T&E
Equipment**

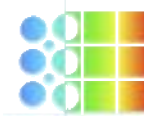


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We're investing in our experimental infrastructure



- HVAC Unit Replacements
- Fiber System Upgrades
- Office & Rest Room Upgrades
- Shaker Renovation
- Control Room Modernization



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Summary

- We have a diverse set of experimental research experts who are internationally recognized
- We have the latest facilities and laboratories
 - *Ongoing capital equipment purchases*
 - *Ongoing facilities & infrastructure investment in laboratories*
 - *Ongoing maintenance & operations investments in laboratories*
- Our research and projects are cutting edge

